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ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

INDEXED

Report On

PROJECT NO. 40 - MILITARY CHARACTERISTICS OF SPECTACLE-TYPE
BINOCULARS

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Project No. 40

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30 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky

Project No. 40
413.74/256 SPMEA

30 May 1944

MILITARY CHARACTERISTICS OF SPECTACLE
TYPE BINOCULARS

1. PROJECT: No. 40 - Military Characteristics of Spectacle-Type Binoculars.

a. Authority: First indorsement by Office of Surgeon General to Letter, Headquarters Army Ground Forces, File 413.74/256 (2 May 1944), GNRQT-6/81689 dated 2 May 1944, Subject: Spectacle Type Binoculars.

b. Purpose: To provide military characteristics of head supported binoculars.

2. DISCUSSION:

a. Requirement has been indicated for binoculars to be worn by aerial observers in a manner similar to goggles without the use of hand support.

b. The requirement indicates two powers, three (3) and six (6). The three (3) power problem is relatively simple, inasmuch as a Galilean system includes a minimum of optical components and is very simple in shape.

c. With the lower power, the requirements for steadiness of mount are much diminished, making the chances of success much greater. It should be remembered that in such devices the image motion is multiplied by a factor one less than the power; thus, for three (3) power, there will be two (2) times the normal image motion; for six (6) power, five (5) times the normal image motion.

d. In the case of the six (6) power, however, a prismatic system is inevitable as the field of a Galilean would be too small and the length prohibitive.

e. Much effort has been spent in making the standard binocular as light as possible; hence, the margin of possible gain in reduction of weight is little. Considerable gain has been made, however, in the proposed form by reducing the moment of the weight and lowering the center of gravity.

3. RECOMMENDATIONS:

- a. That an experienced producer of binoculars be authorized to build two (2) pilot models of the six (6) power prismatic spectacle type binoculars in accordance with specifications in Appendix A.
- b. That the method of support be made a subject of experimental study upon completion of the model.
- c. That two pilot models of a Galilean type, three (3) power spectacle binocular be constructed of plastic optics by a manufacturer experienced in design and construction of plastic Galilean instruments, in accordance with Appendix B.
- d. That the head support of this type be made a subject of further study upon completion of model.
- e. That the development of both these types of spectacle binoculars be carried out by the manufacturer in close collaboration with the Physics Section of the Armored Medical Research Laboratory.

Submitted by:

Lt. Col. F. S. Brackett, Sn C

APPROVED

Willard Machle

WILLARD MACHLE
Colonel, Medical Corps
Commanding

3 Incls.

- #1 - Appendix A
- #2 - Appendix B
- #3 - Figs. 1 & 2

APPENDIX A

SIX (6) POWER

1. Optical Specifications:

Conventional poro prism erection of image
Ocular - Erfle type
Interpupillary adjustment - 58-72 mm
Power - six (6) times
Exit pupil - 4.66 mm
True field - 10°
Objective diameter - 28 mm
Objective EFL - 98 mm
Ocular EFL - 16.33 mm
Clear eye distance - 9 mm
Resolving power on axis - minimum 8 seconds
All non-reflecting air-glass surfaces to be bloomed
(half wave coated)

2. Mechanical Specifications*

a. Instrument (without eyecups)

Length - not to exceed 2-5/8 inches
Width - not to exceed 7 inches
Weight - not to exceed 20 ounces
Center of gravity - not more than 1-3/4 inches in front
of the eye and approximately 7/8 of an inch below the
eye.

b. Eyecup head rest

Instrument to be provided with individual right and left handed components shaped for each eye to the contour of the face and supported by thin spring steel swivelled about the ocular seat. This will be a combination of firm rubber immediately around the eye and forming a flap, partially over the nose and over the eyebrow, together with soft rubber (air-foam) cushion bearing on the temple; chief support will come from the cheek-bone over which firmer rubber is shaped and supported by a downward extension of the spring steel backing. The entire rubber cushion will be held in place by an edge of the rubber rolled over the rim of the spring backing. Weight of head supporting eye cups - not to exceed two (2) ounces each, making the total weight of the assembled instrument not to exceed twenty-four (24) ounces.

3. General Description (See Figure 1).

The instrument does not depart markedly from conventional structure.

* Items not specifically mentioned are to be in accord with standard Army specifications for 6 x 30 binoculars.

The two poros are of dissimilar size; the one near the eye being $3/4$ inches wide with 1.0 inch displacement of sight; the one nearer the objective with 1.1 inch displacement of line of sight, the larger poro being somewhat tapered. The following are the chief departures from conventional structure:

Both ocular and objective are sunk into the instrument beside the poros. This is made possible by the reduction in focal length and the use of longer poros. Assembly is from the front instead of the eyepiece side, thereby making it possible to form the casting around the back side of the larger poro. Nasal clearance necessitates the shortening of the hinge which provides the inter-pupillary adjustment. The loss in length is compensated for by an increase in the diameter of the bearing faces. Provision should be made for attachment of straps or metal bands at the side and at the top of each telescope, approximately $1/4$ inch behind the center of gravity.

4. Discussion

This instrument has been developed around the specified six(6) power, every effort having been made to obtain the most compact arrangement possible. The total length of the instrument has been reduced by two inches below the conventional practice. The disposition of the poros is approximately upside down from the conventional binoculars, thus placing the objective and larger poro below the eye level. This makes it possible to greatly lower the center of gravity, thereby increasing the stability. Despite all these measures the chief of which is bringing the center of gravity nearer the eye and below it, the success to be attained in a head mounted six (6) power binocular remains somewhat in doubt. It does not appear practicable to decrease the weight of the instrument more than a couple of ounces below that of a standard 6 x 30 binocular. No difficulty is anticipated due to the weight per se, but the steadiness which must be obtained to use six (6) power places a severe requirement on the head mounting. If the instrument could be steadied with one hand, there would be no doubt at all of its success.

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APPENDIX B

THREE (3) POWER (See Fig. 2)

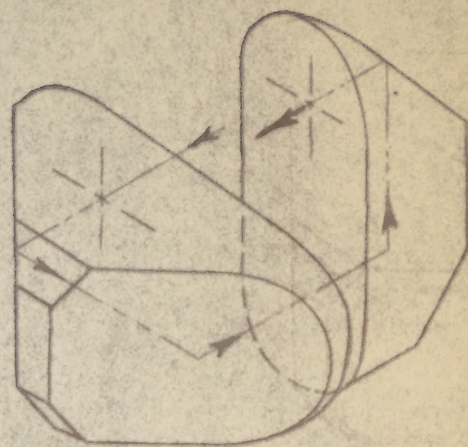
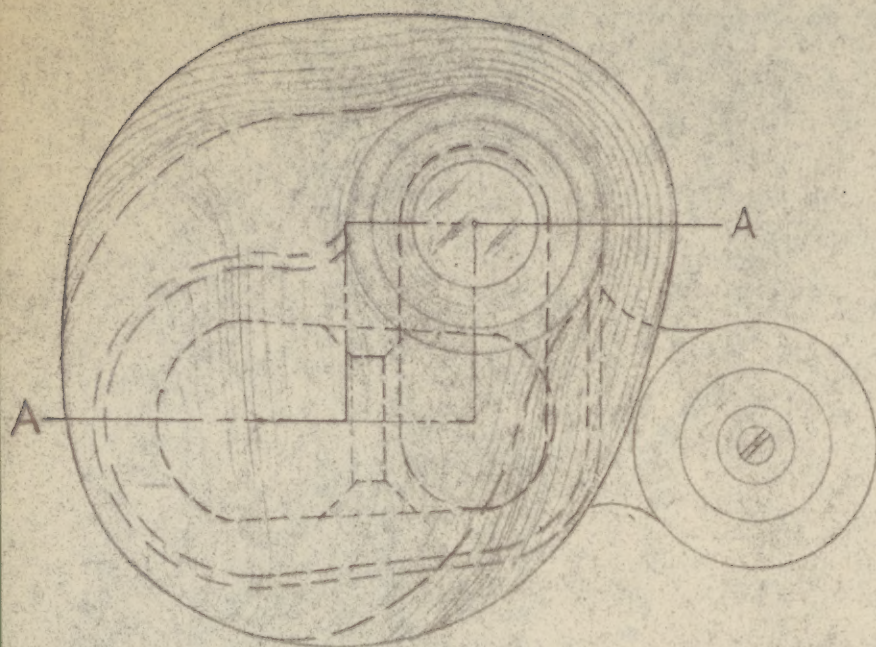
1. Optical Specifications:

Galilean type, three (3) power
Objective EFL - 75 mm
Diameter - 50 mm
Ocular EFL - 25 mm
Diameter - 20 mm
True field - minimum 10°
Resolving power on axis - 15 seconds
Interpupillary adjustment - 58 to 72 mm
Focus fixed at minus 0.75 diopters
Provision for head support the same as in Appendix A
Weight of instrument (plastic) - 8 ounces
Total weight - 12 ounces

2. General

The employment of plastic optics, together with plastic barrels, should be seriously considered for this unit because of the great saving in weight.

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PRISM SYSTEM

CHARACTERISTICS

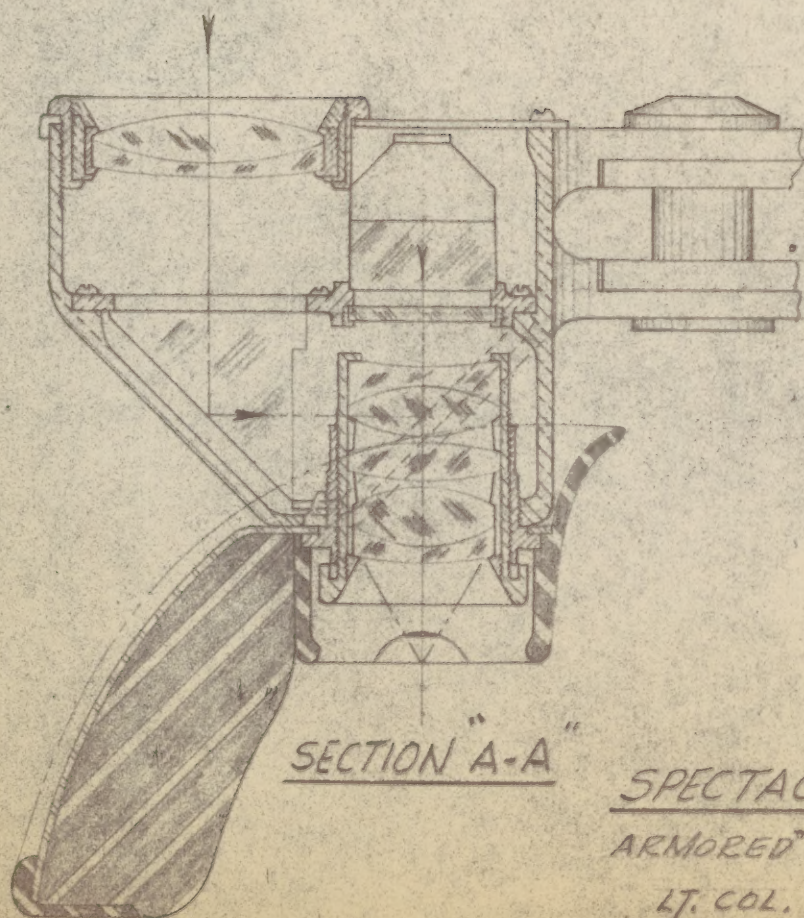
POWER = 6x

FIELD OF VIEW (TRUE) = 10°

DIA. OF EXIT PUPIL = 4.66 MM

E.F.L. OF OBJECTIVE = 98 MM

F.F.L. OF EYEPIECE = 16.33 MM



SECTION "A-A"

FIG. 1

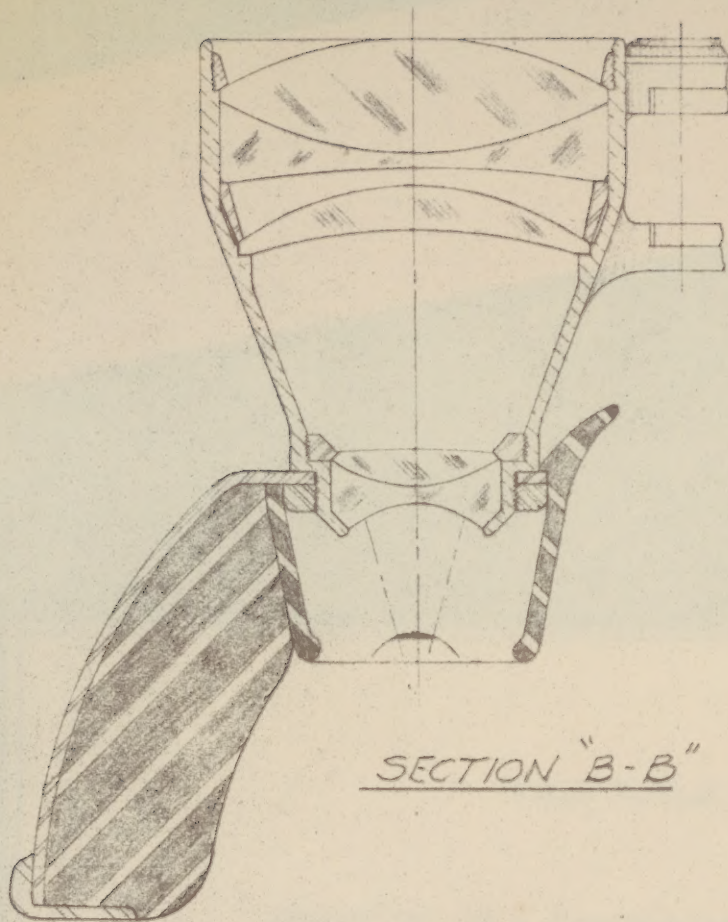
SPECTACLE PRISM BINOCULARS

ARMORED MEDICAL RESEARCH LABORATORY

LT. COL. F.S. BRACKETT · MAY 26, 1944

SCALE - FULL SIZE

Incl # 3



CHARACTERISTICS

POWER = 3 x

FIELD OF VIEW (TRUE) = 10°

E.F.L. OF OBJECTIVE = 75 MM

E.F.L. OF EYEPIECE = 25 MM

SECTION "B-B"

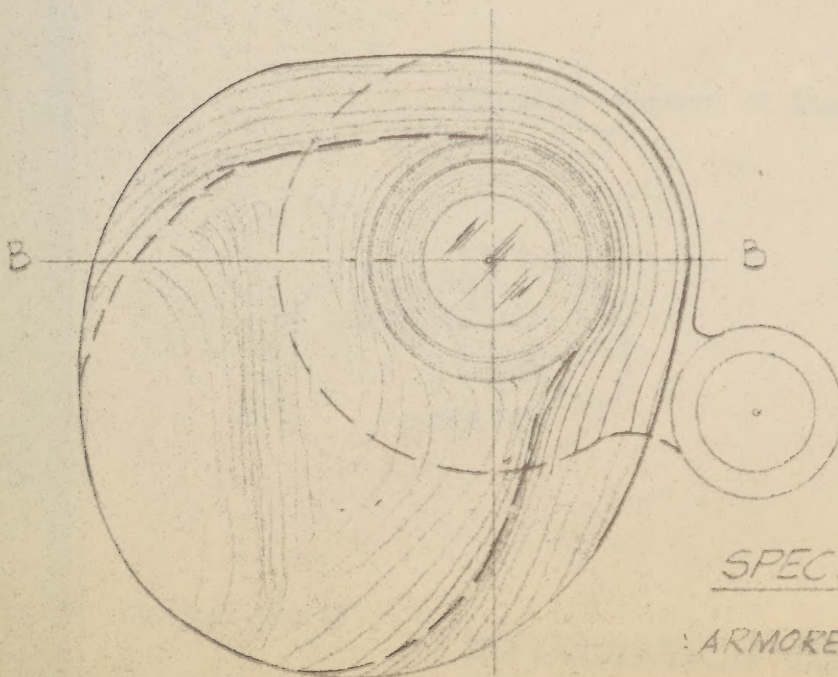


FIG. 2

SPECTACLE GALILEAN BINOCULARS

ARMORED MEDICAL RESEARCH LABORATORY

LT. COL. F.S. BRACKETT MAY 27, 1944

SCALE - FULL SIZE

Incl # 3

